



A.D. 1853 N° 2657.

Furnaces and Fire-places.

LETTERS PATENT to John Ferguson, of Heathfield, in the County of Lanark, North Britain, Brick and Pottery Manufacturer, for the Invention of “**IMPROVEMENTS IN FURNACES AND FIRE-PLACES, AND IN THE PREVENTION OF SMOKE.**”

Sealed the 16th May 1854, and dated the 16th November 1853.

PROVISIONAL SPECIFICATION left by the said John Ferguson at the Office of the Commissioners of Patents, with his Petition, on the 16th November 1853.

I, JOHN FERGUSON, of Heathfield, in the County of Lanark, North
5 Britain, Brick and Pottery Manufacturer, do hereby declare the nature of the said Invention for “**IMPROVEMENTS IN FURNACES AND FIRE-PLACES, AND IN THE PREVENTION OF SMOKE,**” to be as follows:—

This Invention relates to the so arranging the flues and furnace
details of steam boiler and other furnaces that considerable economy
10 in fuel may be secured, whilst the usual discharge of smoke is avoided. As adapted for an ordinary cylindrical boiler furnace with an external fire, a cold air supply pipe is led into the furnace seat or mounting on each side of the fire door at the front end. This pipe or flue runs

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horizontally into the seating, and passes in each case by a slight bend into a narrow horizontal flue formed in the seating, just beneath the level of the flame bed, beneath the boiler and behind the bridge. This flue runs along beneath the flame bed, and is only separated therefrom by a slight thin cover to the further end of the boiler; here 5 it takes a bend outwards, and returns back to the front end in a line parallel to the first run of the flue, and at the same level. In this way the cold air takes up considerable heat from the flame bed, and in this heated state it is passed amongst the gases as they pass from the grate. For this purpose the extreme front end of the flue passes by a short 10 bend or angle towards the line of the boiler's centre, and here enters the outer end of a hollow or cellular bridge standing up from the base of the seating at the back end of the grate bars. Precisely the same arrangement is followed out on each side of the boiler, and the hollow bridge has a central division across it to prevent the mingling of 15 the two currents. At the back of the hollow bridge are a set of openings or jet passages, so that the heated air supplied to the bridge chamber can thus escape in a diffused state on the side furthest from the grate bars; here the air jets mingle with the gases, passing over the front hollow fixed bridge, and the whole current of mixed heated air 20 and gases then passes onwards and strikes against the front of a vertical hanging bridge of considerable depth. This bridge stops the progress of the current, and enables the component matters thereof to become fully mixed. In this state the combined current descends and passes beneath the bottom edge of the hanging bridge, and rises up at the 25 other side and over the top of a third bridge or flame spreader into the flame bed. Thus there are, as it were, two mixing chambers for the air and gases, and the whole become well commingled, whilst an economical use is made of the flame bed heat in passing the cold air along the bottom flues. Although this arrangement has been specially 30 mentioned in its application to a certain kind of steam boiler, yet it is equally applicable to all other varieties of furnace or fire place, whether for steam purposes or not.

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SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said John Ferguson in the Great Seal Patent Office on the 16th May 1854.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I
5 **JOHN FERGUSON**, of Heathfield, in the County of Lanark, North Britain, Brick and Pottery Manufacturer, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Sixteenth day of November, in the year of our Lord One thousand eight hundred and fifty-three, in the
10 seventeenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said John Ferguson, Her special license that I, the said John Ferguson, my executors, administrators, and assigns, or such others as I, the said John Ferguson, my executors, administrators, or assigns, should at any time agree with, and no others,
15 from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "**IMPROVEMENTS IN FURNACES AND FIRE-PLACES, AND IN THE PREVENTION OF SMOKE,**" upon the
20 condition (amongst others) that I, the said John Ferguson, by an instrument in writing under my hand and seal, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next
25 and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said John Ferguson, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the accompanying Drawings, and to the letters and figures marked thereon, that
30 is to say:—

My said Invention relates to the so arranging the flues and furnace details of steam boiler and other furnaces that considerable economy in fuel may be secured, whilst the usual discharge of smoke and uncon-

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sumed gases is avoided. As adapted for an ordinary cylindrical boiler furnace with an external fire, a cold air supply pipe is let into the furnace seat or mounting on each side of the fire door at the front end. This pipe or flue runs horizontally into the seating, and passes in each case by a slight bend into a narrow horizontal flue formed in the 5 seating just beneath the level of the flame bed, beneath the boiler and behind the bridge. This flue runs along beneath the flame bed, only separated therefrom by a slight thin cover to the further end of the boiler; here it takes a bend outwards, and returns back to the front end in a line parallel to the first run of the flue, and at the same level. 10 In this way the cold air takes up considerable heat from the flame bed, and in this heated state it is passed amongst the gases as they proceed from the grate. For this purpose the extreme front end of the flue passes by a short bend or angle towards the line of the boiler's centre, and here enters the outer end of a hollow or cellular bridge standing 15 up from the base of the seating at the back end of the grate bars. Precisely the same arrangement is followed out on each side of the boiler, and the hollow bridge has a central division across it to prevent the mingling of the two currents. At the back of the hollow bridge are a set of openings or jet passages, so that the heated air supplied to 20 the bridge chamber can thus escape in a diffused state on the side furthest from the grate bars. Here the air jets mingle with the gases passing over the front hollow fixed bridge, and the whole current of mixed heated air and gases then passes onwards and strikes against the front of a vertical hanging bridge of considerable depth. This bridge 25 stops the progress of the current, and enables the component matters thereof to become fully mixed. In this state the combined current descends and passes beneath the bottom edge of the hanging bridge, and rises up at the other side and over the top of a third bridge or flame spreader into the flame bed. Thus there are, as it were, two mixing 30 chambers for the air and gases, and the whole become well commingled, whilst an economical use is made of the flame bed heat in passing the cold air along the bottom flues. Although this arrangement has been specially mentioned in its application to a certain kind of steam boiler and fittings, yet it is equally applicable to all or most other varieties of 35

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furnace or fire place, whether for steam purposes or not ; and in order that my said Invention may be properly understood, I shall now proceed to describe the several Figures on the Sheet of Drawings hereunto attached. Figure 1, on the Sheet of Drawings is a front end elevation
5 of a steam boiler and furnace arranged according to one modification of my Invention ; Figure 2, is a vertical longitudinal section of the same taken through the centre of the boiler ; Figure 3, is a vertical transverse section, one half taken through the air space immediately in front of the apertures by which the air enters the main flue, and the other
10 half taken a little behind this, where the entering branches of the air passage bend in towards the centre line of the furnace ; Figure 4, is a horizontal longitudinal section of the furnace, one half being taken at two different levels through one of the air passages, and the other at a higher level, so as to exhibit the route of the main flue. The boiler A,
15 which I have selected for representation in combination with my improved furnace, is of the ordinary cylindrical form, having hemispherical ends. It is embedded in a rectangular structure or seat of brickwork B, in which are formed the furnace, flue, and air passages. The grate C, is at one end of the boiler, and the main flue D, issuing from it at the back,
20 first passes over the bridge E, and then under the hanging bridge F ; after this it runs along under the boiler until it reaches its back end, where it takes a turn upwards to the left hand side, as at G, and returns along this side of the boiler to the front at H it next runs back along the right side of the boiler, and finally passes off to the chimney at I.
25 The entrances to the air passages, of which there is one on each side of the furnace, are at J, a little below the level of the fire bars. These entrances are provided with throttle valves or adjustable passages K, for adjusting the indraught of air, the spindles of the valves passing through the brickwork into the ashpit, where they have lever handles
30 L, fixed upon them, by means of which they can be set in any required position. These air passages pass horizontally and parallel with the boiler's axis, to a short distance behind the hanging bridge F, they then turn inwards as at M, and continue their course towards the back end of the boiler, as at N, immediately below the main flue D, being separated from this last by a very thin partition O. On reaching the back
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of the boiler the air passages diverge to the right and to the left; as at P, at the same time rising to a higher level; they thence return to the front end of the boiler as at Q, being also here separated from portions of the main flue by thin partitions R; they finally descend as at S, to a space T, formed inside the bridge E, and this space T communicates 5 with the main flue D, by apertures U, in the back of the bridge E. In this manner, the air entering at J, in traversing the range of passages just described, takes up the heat radiated from the main flue through the thin partitions O and R, thereby utilising this heat, which would otherwise be more or less wasted, whilst at the same time the air thus heated 10 acts more efficiently on commingling with the gases proceeding from the furnace, so that the fuel is more thoroughly and perfectly consumed, none passing off in the form of smoke. According to another modification of my said Invention, the air entering by openings at any suitable or convenient point or points, is first made to traverse passages on the 15 side of or below such portions of the main flue as are furthest from the fire, and is afterwards made to pass through passages immediately below or on the sides of that portion of the main flue which is nearest to the fire, and is consequently the hottest, the air being thence admitted into the main flue so as to mingle with the gases therein, in a similar 20 manner to that described in reference to the modification which I have first explained. In all cases the air passages are divided off from the portions of the main flue by very thin partitions, so that the air may take up the radiated heat as easily as possible. It is to be understood that by the general system of introducing air, as I have herein-before 25 described, the air so admitted is heated to such an extent as to prevent all danger of cooling the furnace or lowering the steam pressure in the boiler. By the herein-before described plan I effect the complete combustion of the smoke and the combustible gaseous products, whilst I at the same time secure great economy in the consumption of fuel 30 as compared with existing systems; with my arrangements I also effect a great saving in attendance, as when once properly set the proper action of the furnace is kept steadily up without any further adjustment of the valves or other details, except in cases of extraordinary variation in the working routine.

FIG. 1.

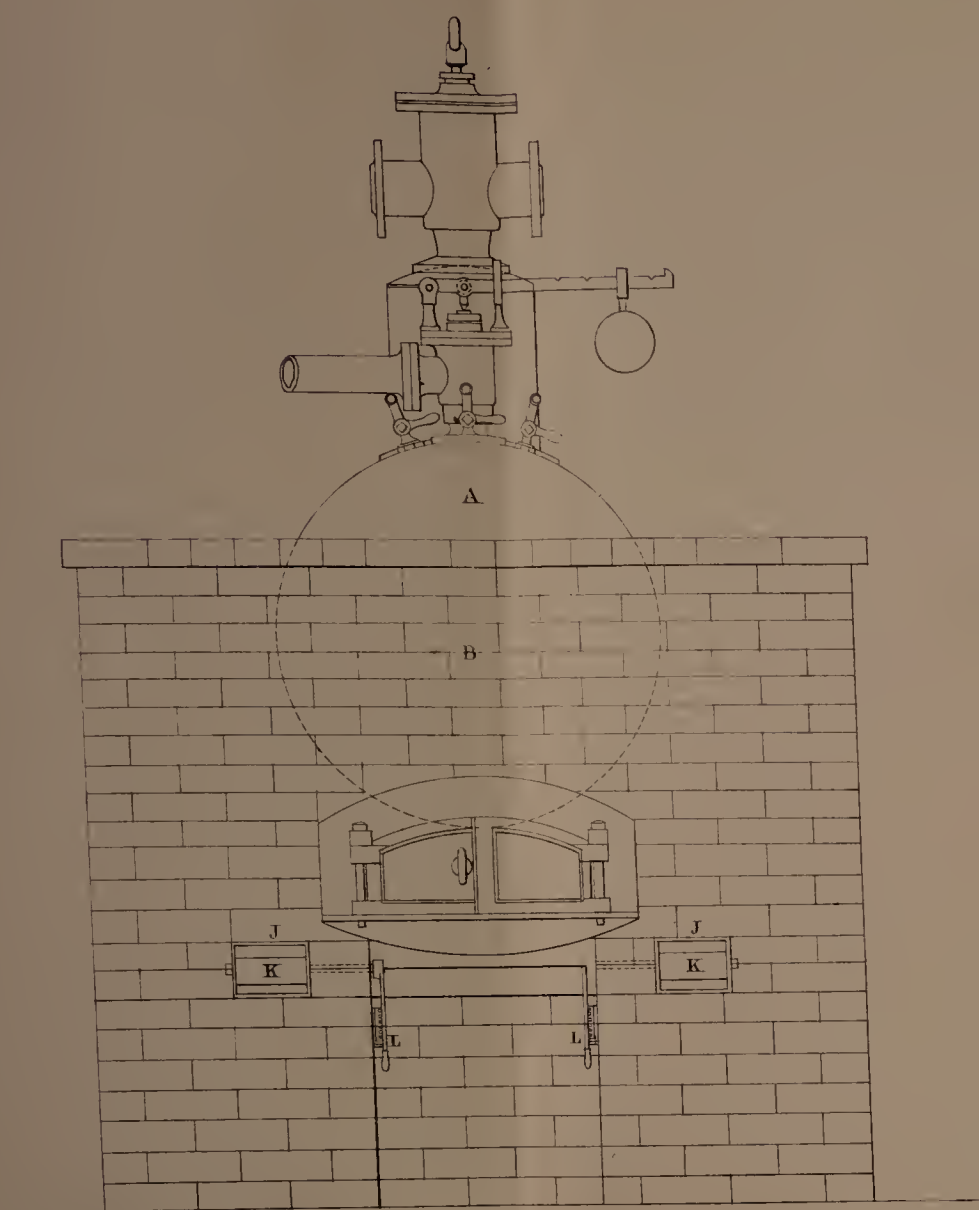


FIG. 2.

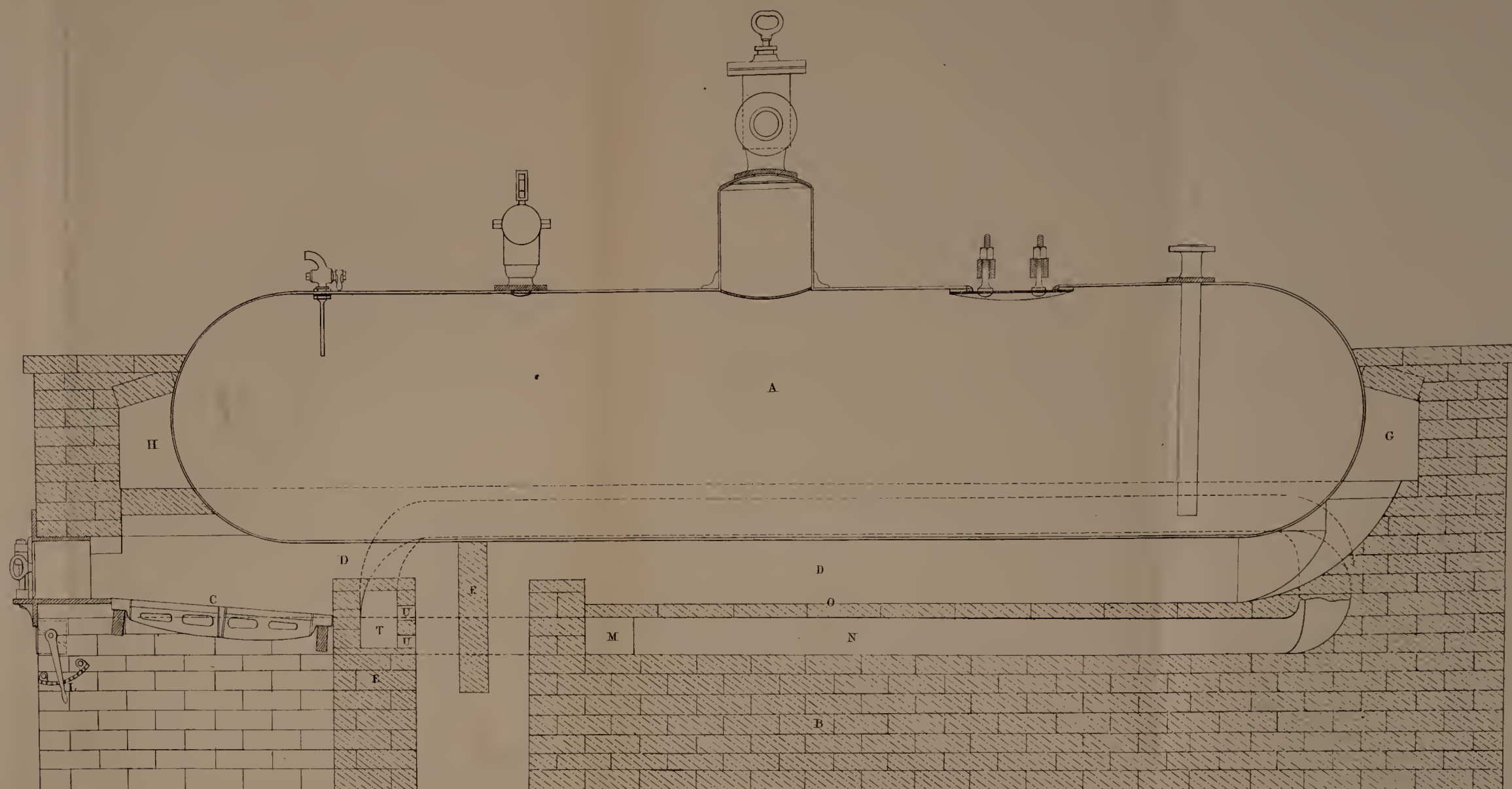


FIG. 3.

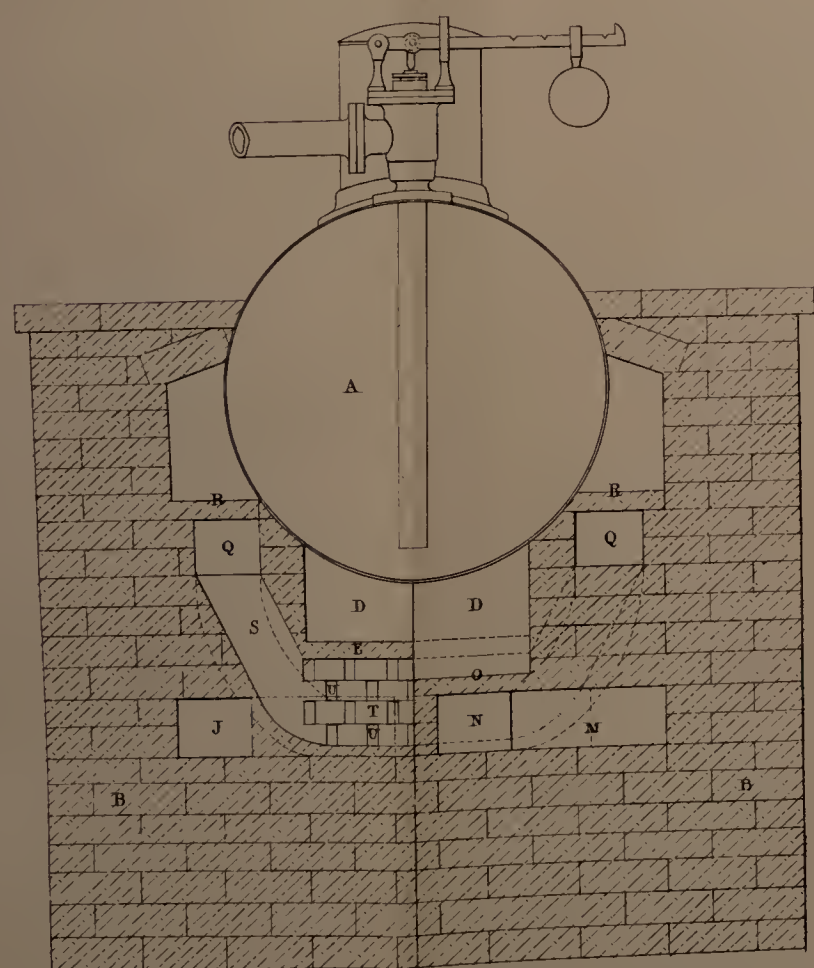
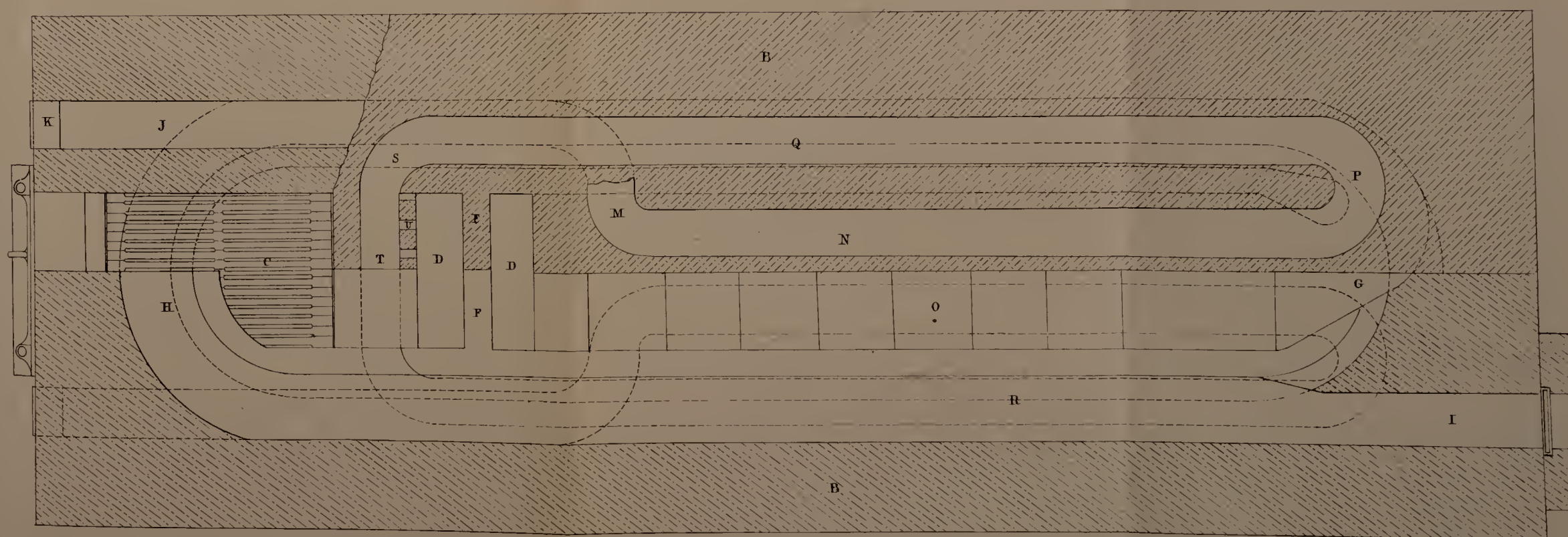


FIG. 4.



The filed drawing, is colored.

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Having now described and particularly ascertained the nature of my said Invention, and the manner in which the same is or may be used or carried into effect, I may observe, in conclusion, that I do not confine or restrict myself to the precise details or arrangements which I
5 have had occasion to describe or refer to, as many variations may be made therefrom without deviating from the principles or main features of my Invention; but what I consider to be novel and original, and therefore claim as the Invention secured to me by the herein-before in part recited Letters Patent, is,—

10 First, the general arrangement and construction of furnaces or fire-places, as herein-before described.

Second, the system or mode of constructing furnaces or fire-places wherein passages are formed for the introduction of air into the main flue or flues, such passages being carried along close to the main flue
15 passages, from which they are separated by very thin partitions, so that the air may take up the heat radiated from the main flues, as herein-before described.

Third, the system or mode of arranging and constructing furnaces or fire-places wherein a hanging or intermediate bridge is combined with
30 or inserted in a mixing or combination chamber, for the commingling of the gaseous products of combustion and air.

Fourth, the system or mode of arranging and constructing furnaces or fire-places wherein the gaseous draught current takes a descending and ascending or tortuous route through a mixing or combination
25 chamber.

Fifth, the application and use of brick or earthenware ducts or passages for heating the air prior to entering the furnace or flue.

In witness whereof, I, the said John Ferguson, have hereunto
set my hand and seal, this Twelfth day of May, in the year
30 of our Lord One thousand eight hundred and fifty-four.

JOHN FERGUSON. (L.S.)

LONDON :

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Printers to the Queen's most Excellent Majesty. 1854.

